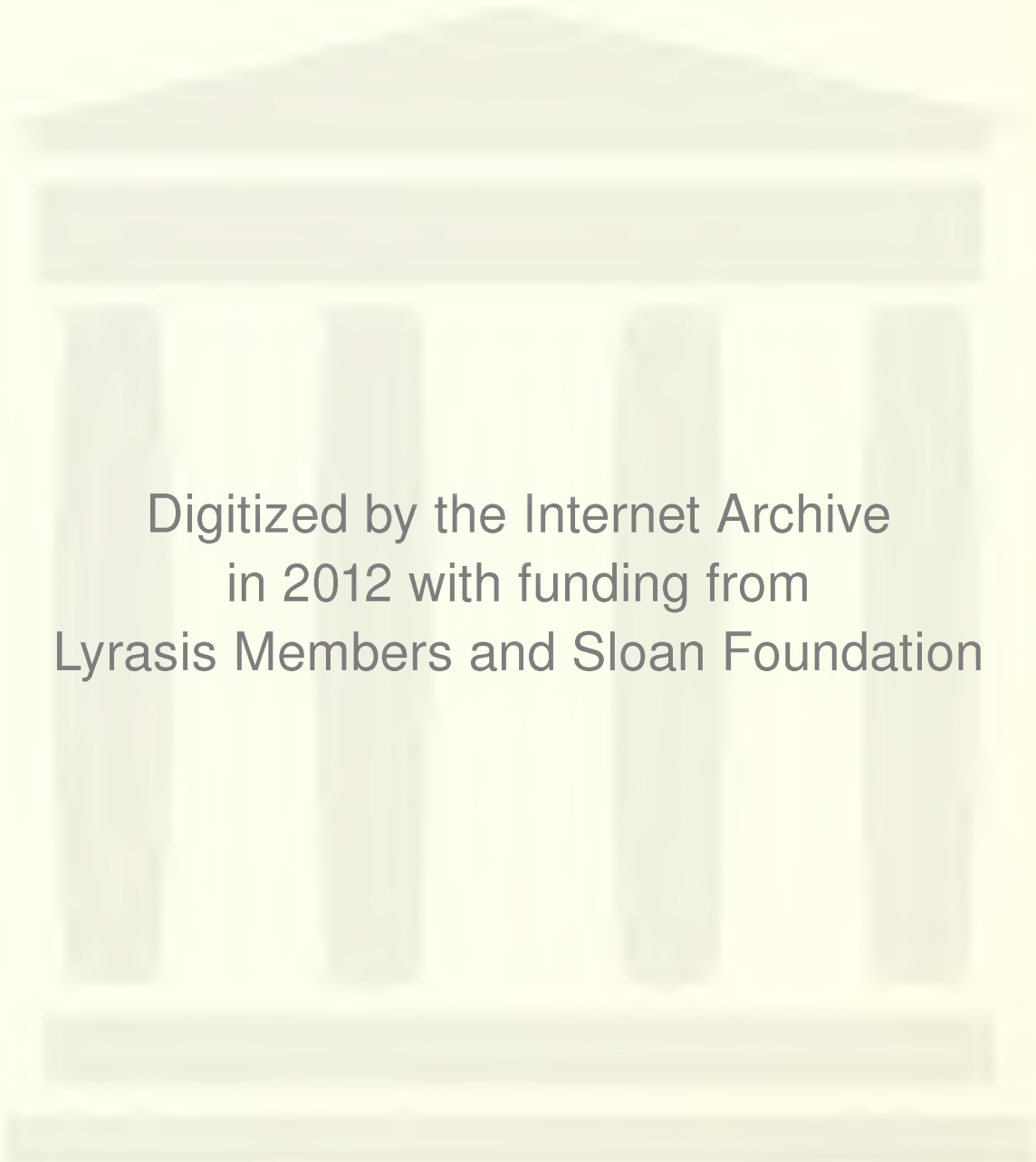

FINAL REPORT

Housing Accessibility for Individuals with

Visual Impairment or *Blindness*

Conducted by:
Richard G. Long, Ph.D.
722 Dorsey Circle
Lilburn, Georgia 30247

For the:
Center for Accessible Housing*
School of Design
North Carolina State University
Raleigh, North Carolina
Ronald L. Mace, FAIA
Principal Investigator

**Supported by*
the National Institute on
Disability and Rehabilitation Research
US Department of Education

July, 1992

Introduction

This report summarizes the results of a study of housing design features as they relate to everyday functioning of individuals with blindness or low vision.* The primary goal of the study was to identify characteristics of housing environments that enhance or limit the independence and safety of these individuals as they perform routine activities in their homes and neighborhoods. The project focused on identifying characteristics or features of the built environment that affect functioning and that cannot be easily altered. Examples of such features include the layout of rooms in the residence and the type and location of windows and other natural light sources. Project staff also obtained information about features of homes that can be altered at relatively low cost, such as the addition of lighting, the use of contrasting colors and textures on walls or floors to aid mobility, and the design and placement of cabinets and other storage units.

To complete this research, two focus groups were conducted. One focus group consisted of working age and older adults with visual impairments. The other group consisted of professionals who serve infants and preschool aged visually impaired children. As a means of structuring the focus group discussions, the group facilitator asked participants to describe housing features in specific rooms or areas of their homes and surrounding area. They were asked to describe the impact of these features on performance of activities that are typically conducted in the area. Participants, for example, were asked to describe the layout and the features of their kitchens, including such features as cabinetry, lighting, and open spaces. They were asked to describe

* In this document, the term "blind" refers to persons who have no usable vision or who have light perception only. The term "low vision" refers to persons who have some remaining vision and are legally blind. The term "visually impaired" is used as a collective term and includes both persons with blindness and those with low vision.

how the features limited or enhanced their ability to prepare meals, eat, or clean up following a meal.

Participants were encouraged to discuss features they would like to have (i.e. those they believed would improve their functioning in a particular area or room). Areas of the home included in the discussion were the kitchen, the bath, the bedrooms and living areas, and the hallways and entryways. Outside areas included the yard and the neighborhood in the immediate vicinity of the home.

In addition to the focus groups, a literature review was completed on housing design and for persons with visual impairment. Limited additional information was obtained from this review, as there apparently has been relatively little study of this topic.

The study resulted in the development of a set of recommendations concerning housing design for persons with blindness or low vision (see Appendix A for a summary of these recommendations). These recommendations should prove useful to housing designers, contractors, and to various human service professionals who serve these individuals. The information and recommendations obtained during this study can improve the quality and availability of housing that meets the unique needs of persons with blindness or low vision.

Context

Approximately 800,000 Americans are legally blind. Of this number, about 85% have usable vision. Slightly more than half of these persons are 65 years old or older, and half of them have other impairments. Older persons are the fastest growing subpopulation of persons with visual impairment in the United States. According to data from the National Center for Health Statistics, almost 13% of older persons, or about 3,000,000 individuals, have blindness or trouble seeing. With advancing age, the number of individuals with blindness or trouble seeing grows dramatically. For example, 27% of persons over 85 years report visual problems. In the next thirty years, the number of older visually impaired individuals is expected to double as the "baby boomer" generation grows older. (See Kirchner, 1988 for additional information on incidence and prevalence of blindness and visual impairment in the US).

Many visually impaired persons receive education and rehabilitation services to help them achieve personal, social and vocational success. Children and youth are entitled by law to receive specialized educational services designed to meet their unique needs. Adults who are blind or visually impaired often receive services from state rehabilitation agencies or from private agencies. These services may include orientation and mobility training, rehabilitation teaching, counseling, vocational evaluation and training, and low vision services. Some older adults receive rehabilitation services and low vision care, but many older adults who could benefit from services do not receive them. This situation arises because services do not exist in many areas and because older persons are either unaware of their existence or reluctant to participate in rehabilitation programs. Federal support for services to visually impaired older persons has been very limited in recent years (Rogers and Long, 1991).

While the focus of rehabilitation services for visually impaired persons is on education and training, professionals and consumers also recognize the impact of housing design features on safety and independence in routine activities. Anecdotal evidence suggests that visually impaired persons often make "low tech" modifications or adaptations to their homes, such as the addition of supplemental lighting or the use of color contrast. Based on the author's review of several bibliographic information sources, it appears that little research has been conducted regarding the extent to which visually impaired persons modify features of their home or select a new residence based on the availability of housing features. In addition, there apparently has been no research published that documents the impact of housing design modifications on the functional abilities of this group.

A review of the literature revealed a number of general articles published on the topic that suggest various modifications that may be beneficial to visually impaired individuals. These articles indicate that, in general, modifications of homes of visually impaired persons are usually "less structural" than modifications made by individuals who use wheelchairs (see Cocke, 1992). Many of the modifications suggested in the literature address the needs of persons with low vision (e.g. addition of supplemental lighting, increase in color contrast, and reduction of glare). Relatively few modifications are reported for blind persons, and most of the recommendations for this group concern modification of controls on consumer products.

Research is needed to determine what kinds of features visually impaired persons have added to their residences, either as "add-ons" to an existing dwelling or as features of new construction. In addition, information is needed about the impact of those features on independence and safety in performing routine activities. The results of such research may prove to be particularly important for specific subpopulations of persons with visual impairment who are likely at risk for impairment of functioning in routine activities or for whom changes in functional abilities are likely to occur. It seems likely, for example, that young children who are developing social, motor, language and cognitive skills may acquire them more readily when environments are designed to encourage movement and interaction with objects and people (Hill, Dodson-Burk, and Smith, 1989). Housing design

features also may significantly improve the functioning of older persons, who often experience onset of late-life disability in addition to visual loss. These multiply disabled older persons may have less capacity to adapt to environmental demands than a younger visually impaired adult, and thus may experience functional limitation in environments that do not significantly limit younger persons with similar disabilities. The study reported here focused on the housing design needs of young children and, to a lesser degree, older persons. This focus was selected because it seemed likely that persons in these two groups may have greater needs for (and may receive greater benefit from) housing design features and other environmental "supports" when compared to working age persons without additional disabilities.

Literature Review

As noted above, the investigator was unable to locate any empirical research regarding the affect of housing design characteristics on the ability of visually impaired persons to perform routine activities safely and independently. However, several articles have been published recently that provide suggestions for housing modifications for this population. Null (1988a, 1988b) focused her work on kitchen design needs of low vision elderly persons. She describes a joint effort of the San Diego Service Center for the Blind (SDSCB) and the School of Design at San Diego State University to design and build three training kitchens for SDBCB's new model apartment. Using universal design criteria (Mace, Hardie, and Place, 1990), Null and her students designed three alternative kitchens that were supportive, adaptable, accessible, and that ensured safety. Supportive features, or those that facilitate ease of operation and maintenance, included D-shaped or lever handles on cabinets, storage visibility through the use of pull-out shelves, and color contrast on switch plates and countertops. Adaptable features included work surfaces that could be raised or lowered and rheostats for control of lighting levels. Accessible features included ranges with front controls, side-by-side refrigerator/freezers, and single lever faucet controls.

Cocke (1992) provides a similar menu of suggested modifications for various locales in the home. Graves, Maxson, and McCaa (1988) describe the validation of a procedure for assessment of environments of persons with low vision. Brennan, Peck and Lolli (1992) offer suggestions for modifying home and school environments for young children. Other literature includes the work of Sicurella (1977) on lighting needs of persons with low vision and a report of the effectiveness of visual-environmental modifications in the workplace (Bradfield and Tucker, 1989). Additional selected readings are cited in Appendix B of this report.

METHOD

Focus groups were the primary means used in this research project to obtain information about housing design for persons with visual impairment. One focus group consisted of blind and visually impaired working age and older adults living in the metropolitan Atlanta area, and rehabilitation professionals who serve these individuals. The other group was composed of professionals with expertise in services to visually impaired infants and preschoolers.

Each focus group was asked to respond to the same questions. The questions were as follows:

- What features of your home enhance or limit your independence and safety in performing routine household tasks?
- What design related solutions do you think could reduce the limitations you experience in routine activities?
- In your opinion, what is the single most important feature of your home related to your ability to complete routine activities?

Focus Group 1 — Atlanta

Thirteen individuals participated in this focus group. Potential participants were identified by the investigator with the assistance of staff from the Center for the Visually Impaired of Atlanta and the Regional Office of the American Foundation for the Blind. The composition of the group was designed to reflect the proportion of persons with blindness to persons with low vision in the United States. Consideration also was given to age, age at onset of visual loss, employment status, and gender. Nine participants were blind or had low vision. One was the sighted mother of a blind preschool child. Of the nine visually impaired persons, four (two men and two women) were totally blind and five persons (three men and two women) had low vision. One of the participants was elderly (a female with low vision). Two

participants were professionals working in blind rehabilitation. One was director of orientation and mobility services at a large private agency in Atlanta and one was a rehabilitation researcher with training and experience as a rehabilitation teacher. Another participant was the spouse of a blind person and a program development specialist for a national education and advocacy program. This participant was trained as an orientation and mobility specialist and had previously worked as a university educator and rehabilitation researcher.

The investigator of the project served as facilitator for the discussion group, and one of the rehabilitation professionals served as recorder. Prior to the meeting, the professionals were asked to allow the consumers to discuss the questions of interest before they entered the discussion. This arrangement allowed professionals to expand on issues of concern without dominating the discussion.

Focus Group 2 — Los Angeles

This group was convened at an international conference on blindness and visual impairment. The group consisted of five nationally known professionals with expertise in services to infants and young children with visual impairment. Each of these persons has been recognized for contributions to research and practice in this area. The meeting was possible because these individuals were attending the biennial meeting of the Association for Education and Rehabilitation of the Blind and Visually Impaired, held in Los Angeles on June 30 - July 4, 1992. The five participants included three university educators working in O&M programs. Two of these individuals emphasize preschool/early childhood O&M in their work with students and in their research. The remaining two attendees were educators working in programs for blind and multiply impaired young children. As in the Atlanta meeting, the investigator served as facilitator of the focus group.

RESULTS

Focus Group 1 — Atlanta

As a means of organizing the discussion of the questions addressed by the focus group, the facilitator requested that each question be considered for several areas on the home. The areas were the kitchen, the common living areas and bedrooms, the bathrooms, the hallways and entryways, and the yard and immediate neighborhood around the home. Results are reported by area below, followed by a discussion of housing design features that are found in more than one area of the home, such as lighting.

Responses By Area of the Home

KITCHEN

Much of the discussion of the focus group centered on the kitchen. Participants with low vision offered many suggestions to improve safety and function in the kitchen. Regarding safety, the group reported that the most important feature in the kitchen was front mounted controls on the stove. All participants had front mounted controls except two, and they had side mounted controls. Another safety feature was the design of cabinets. Kitchen cabinet doors are sometimes left open after use, posing a collision hazard to visually impaired individuals (and others). Participants suggested that sliding doors or spring loaded hinges on cabinet doors be used in new houses. Avoiding protruding handles on cabinetry was also important, as some participants tended to hit them with their hands or wrists. Recessed handles were preferred.

In regard to improved functioning in the kitchen, participants indicated that cabinets with pull out shelves or "lazy-susan" type revolving shelves were useful to persons with low vision because they enabled them to bring the contents of cabinets into view. They suggested that more storage than is commonly available in kitchens would improve functioning by facili-

tating use of organizational strategies that make things easier to find. Having more storage space, for example, would reduce the necessity to stack or nest cookware or groceries in a way that makes them difficult to see. The participants with low vision also indicated that a work surface of table height with clear space underneath was desirable. A surface of this type would allow them to sit and read a recipe book or perform activities such as mixing, slicing, or stirring. While seated, they could bend over to see what they were doing without the back strain that might result from bending over while standing. Several individuals indicated that standing over a standard height counter and bending to bring one's eyes close to the work is fatiguing. Strip lighting under cabinets can be very useful in improving visual functioning in some low vision persons (see the more extensive discussion on lighting later in this paper). Low vision participants also suggested that manufacturers of refrigerators put lights in the freezer as well as the refrigerator.

Other kitchen features suggested to improve safety by persons with visual impairment included:

- Raised outlets (mounted 18"- 24" higher on the wall than usual) to facilitate using low vision to plug in appliances, and outlets between the countertop and overhead cabinets to avoid long lengths of electrical cord from countertop appliances
- Consistency in electrical plug placement (wide side/ground hole consistently placed throughout home)
- Braille or large print labels in breaker box

Other kitchen features suggested to improve functioning by persons with low vision included:

- Countertops with flat finish and solid, neutral color (Avoiding visual clutter is important for persons with low vision. Wallpaper should be solid or a relatively small, subtle pattern that does not clutter the visual background).
- Switches that have distinct positions for "on" and "off." Rocker switches are annoying (and a potential safety hazard) because it is impossible to tell whether the device is on or off from the position of the switch. This is particularly important for persons who are blind.

LIVING AREAS

Extra-wide doorways were desirable for ease of entry and exit to rooms. Pocket or sliding doors were also preferred, as they eliminate the risk

of walking into the edge of a half-open door. Recessed door handles were also a desired feature, as some people reported they tended to hit their wrists and forearms on handles that protruded into the room or hallway. Some participants reported color-contrasting door frames as desirable, as they facilitated location of entryways into a room.

One of the most important features of living areas was the arrangement of furniture. Blind individuals often use furniture to establish a line of travel. They may, for example, trail along the back of a sofa or chair and then continue on that line of travel to find the doorway to a room. Participants reported that maintaining relatively direct, clear paths from doors at each end of a room is also important. Hearing is a critical source of information when traveling in the home, as many blind travelers can "hear" openings. Because they usually travel in their homes without using the long cane, it is important to provide floor and wall coverings that provide a reverberative surface. It usually is easier to locate an object dropped on a hardwood floor than dropped on carpet. The focus group participants also reported that avoiding sunken floor areas in living spaces was very important because they pose a falls hazard.

INTERIOR STAIRS

Railings that begin and end several feet before the first riser was important to one member of the group. The group concurred that stairs should have no open risers and staircases should be closed to avoid the possibility of injury to one's head. Risers should be of equal height and width. Consideration should be given to installation of a nosing of contrasting color on the leading edge of the stair.

BATHROOM

Desirable bathroom features included faucets with separate controls for the hot and cold water, as it may be difficult to know whether the water will be hot or cold when initially turning on a single ball type faucet. Mats and grab bars in shower areas were a desirable safety feature, especially for the older people in the focus group. At least one mirror should be mounted so that it is possible to get very close to it, in order to see to put on makeup and perform other grooming tasks. In keeping with the group's focus on lighting, several participants desired a light in the shower.

ENTRYWAY

Most of the recommendations regarding the entryway concerned personal safety while entering and exiting the home. Participants reported that well lit exterior doors were critical, with motion or sound activated lighting preferred. They desired lighted keyholes and doorbells, and alarm control panels with tactile markings and audible confirmation when keys were depressed. Intercoms that allowed a person inside to answer the door from anywhere in the house were reported to be both a safety feature and a convenience. Door thresholds mounted as flush to the floor as possible reduced the trip hazard of a conventional raised threshold.

The use of a brightly colored post or mailbox was reported to facilitate finding the house from the street or sidewalk. While no participant recommended tactual cues to warn of approaching stairs, consideration should be given to walkway and entryway design that provides tactual cues to changes in elevation.

Sidewalks bordered with grass facilitated finding the entry door in darkness. Clearly delineated paths from the entryway to the sidewalk or street were also desirable. Participants with blindness also reported that larger than usual landings at stairs made going in and out of doors easier.

Responses relevant to the home in general

CONTROLS

Individuals with low vision benefited from large print or large LED readouts on their thermostats, while some blind participants reported that they had thermostats with tactile markings and audible feedback when the dial is turned (e.g. one click equals 2 degrees). Keypad entry of desired temperature on a digital thermostat was reported by several persons to facilitate setting the thermostat.

LIGHTING, COLOR, CONTRAST, GLARE

Much of the discussion at the Atlanta focus group related to lighting issues. Increased lighting helps most (but not all) persons with low vision in completing routine activities. All participants with low vision at some time during the meeting mentioned the desirability of adding both natural and artificial light sources throughout the home. Natural light was reported to be

particularly desirable. More important than lighting per se, however, was the ability to control lighting. This report is not surprising, given that low vision individuals tend to have unique lighting needs depending on the degree and type of vision loss, the task for which lighting is required, and the individual's sensitivity to glare. The majority of participants reported that the addition of lighting and its control was a more important feature than the addition of color contrasting surfaces, although both were beneficial modifications for some individuals. Contrast was reported to be a more important feature outside the home, which is not surprising given that lighting is more difficult to control outside than inside. Use of flat finishes on counters and floors was reported to decrease problems with glare.

Suggestions for lighting aids inside the residence included use of rheostats on all light switches to permit a wide range of adjustment of light levels. Control of lighting with rheostats and adjustable blinds was the most important feature of lighting. Large windows and skylights that are tinted to reduce glare were reported to be very useful. This finding is not surprising, given that natural light is preferable to artificial light for many visual tasks. The combination of increased lighting (both the wattage of bulbs and the number of fixtures), the ability to control lighting, reduction of glare sources, and the use of color contrast to mark edges and borders appears to be a powerful environmental intervention for persons with low vision.

Summary of the Atlanta Focus Group

Participants in the Atlanta group were asked at the close of the meeting to name two or three features of their living environment they believed were most important for insuring safety and ease of performance of routine activities. Ten of the attendees said that ready access to public transportation was the most important feature of their living environment.

Other responses included (number of respondents in parenthesis):

- well-lit area around home (3)
- adapted security alarm (1)
- large, open living areas with good contrast and low visual clutter (2)
- level, open lot with definable borders or fences (2)

- presence of sidewalks in the neighborhood (1)
- lots of natural and artificial light with variable control (2)
- ranch style house—minimal stairs and wheelchair accessible (in anticipation of the onset of additional disabilities) (1)
- well-lit stairwells (1)
- grab bars in bath (2)
- cabinets with accessible design features (1)
- Plenty of electrical outlets and outlets mounted higher on the wall than normal (2)

Focus Group 2 — Los Angeles

The purpose of the focus group convened in Los Angeles in conjunction with the meeting of the Association for Education and Rehabilitation of the Blind and Visually Impaired was to obtain information regarding housing design needs of young children with blindness or low vision. As noted in the introduction, young children were selected for investigation because the design of the home environment likely plays a major role in facilitating the development of motor, social, cognitive and language skills in these children. For example, environments that allow for safe movement and that facilitate the use of organizational strategies could be hypothesized to enhance early development, while environments that are visually cluttered or that pose safety hazards during independent movement may impede acquisition of mobility-related knowledge and skill.

Responses By Area of the Home

BATHROOM

In regard to the bath, participants reported that children often find it difficult to regulate water temperature using some types of controls, particularly faucets with single controls. Consideration should be given to the fact that young children may have limited wrist control and difficulty reaching the faucet. Independence in bathroom tasks may be facilitated with dual lever faucet controls that permit easy manipulation of the flow of water.

ENTRYWAY AND YARD

A defined path to the car from the house was reported by the focus group participants to be important for blind and visually impaired children, as it fosters independence in outdoor mobility. Safe play areas delineated by fencing (preferably solid fencing) or continuous hedges may facilitate outdoor play by enabling children to play outside unaccompanied by an adult. The ability of young blind children to go in and out of their homes independently in order to play outdoors in a safe environment may have a significant impact on development. Providing children with safe, developmentally age-appropriate climbing structures that they can access on their own may, for example, encourage motor development and the acquisition of spatial concepts.

LIVING AREA

Where possible, furniture should be aligned with doors leading into or out of a room, as it can serve as a useful guide for establishing a line of travel to find a door.

Responses relevant to the home in general

THE RELATIONSHIP OF HOUSING DESIGN TO CHILDRENS' PLAY ACTIVITY

Many of the comments of the Los Angeles focus group centered on environmental design as a means of enhancing childrens' opportunities for independent play. Play was considered by the group as a critical means of providing learning experiences for young visually impaired children. Housing-related modifications that improve play opportunities were considered to be among the most important modifications that could be undertaken. Many of the modifications were relatively "low tech" and required little structural modification. For example, the professionals reported that they often encouraged parents to use carpet pieces to designate safe play areas and to provide tactual cues for entryways into rooms. Defined spatial boundaries and consistency in the placement of objects throughout the house was reported to be a critical factor in the development of spatial relations abilities and to orientation and mobility. The use of low bookshelves with tactually and visually marked cubicles reportedly facilitated independent play by allowing children to "designate" specific places for specific toys.

Blind children may have difficulty retrieving toys they drop. A play table with raised lip also may assist children in play, as it prevents toys from slipping off the edge easily. The ability to control or vary lighting through the use of rheostats is likely to be advantageous to young children in activities such as reading or coloring. The Atlanta focus group noted a preference for incandescent light, as it appears to provide a "warmer" light and avoids the flicker that can be associated with use of fluorescent lighting. Children may prefer incandescent lighting as well. Children with blindness or low vision also may find that door frames or chair rail that contrasts visually or tactually with the wall covering may facilitate mobility by enabling them to locate openings readily.

HOUSING DESIGN FEATURES THAT IMPROVE HOME SAFETY FOR VISUALLY IMPAIRED CHILDREN

To ensure safety, participants recommended that outlets be placed above the reach of a young child. Heaters should not pose a burn risk if touched. Anti-scald valves should be placed on hot water lines. Placement of furniture is also a consideration. Where possible, furniture should be against walls and should not block the direct path from one side of the room to another. Rounded edges on furniture, cabinets and counters may reduce likelihood of injury. As with older persons, spring loaded cabinet hinges, sliding cabinet doors, and non-protruding handles may be useful safety features with young children. Tracks in sliding doors may pose a significant trip hazard for young blind children (and adults as well). Tracks should be level with the floor.

Summary of the Los Angeles Focus Group

The responses of the Los Angeles focus group document that housing design features can affect the ability of children to play independently and to be independent in various activities of daily living. The professionals also stressed the need to consider the developmental level of the child when decisions are made regarding modifications of homes. As children develop more advanced cognitive skills and begin to travel independently, for example, it may be important to increase the child's awareness of subtle, naturally occurring auditory or visual cues rather than relying on artificial boundaries, such

as carpet strips marking a play area. Children should be encouraged to make choices and take initiative in acting upon their environment. For example, it is important to provide children who are visually impaired with kitchen cabinets that they can access freely, enabling them to make choices (within limits) about the kinds of snacks they want. Well delineated storage areas for toys should facilitate the child's ability to independently transition from one play activity to another. Providing guidance to the child about organizational strategies for toys, clothing or school supplies is needed, but as the child grows he or she should begin to design and implement his or her own organizational strategies. A "trial run" with a housing design feature or organizational strategy is often appropriate, and the teacher and parent must be skilled observers of their impact on the child's behavior. Housing design features may need to be modified based on a trial period. The needs of young siblings and other members of the household must also be considered, as it is important to avoid structuring the play or living environment in a manner that impedes the development or functioning of family members who are not disabled.

According to the Los Angeles group, the most important issues are:

- insuring the child's safety, with emphasis on designating clear paths and safe play areas
- facilitating access to toys, clothes, snacks and using environmental design features to encourage safe, independent play and the ability to make independent decisions about toy or activity selection
- using increased lighting and encouraging children to control lighting to maximize visual functioning
- using well-defined play areas and travel paths, usually with tactual "borders" or fixed auditory cues, to facilitate movement within the home and yard

Discussion

Several conclusions can be drawn from the information provided by the two focus groups. Not surprisingly, there was a great deal of variability in response to the question regarding the most important issue in housing design. Factors such as age, degree of visual loss and age of onset, perceived housing needs, and attitudes about routine task performance probably affected the responses of participants to this question. The variability of responses suggests that design features must be tailored to the needs of individuals rather than applied in a "general" or cookbook manner in hopes that they will facilitate task performance for all. Perhaps the best example of the need for individualization is seen in the responses regarding lighting made by the Atlanta focus group. Adequate lighting for one individual with low vision can produce a disabling amount of glare for another. The fact that the Atlanta group viewed the ability to control lighting as more important than the addition of lighting reflects their desire to adjust lighting to "fit" the demands of a given task. Individuals providing housing related services to blind or low vision consumers must become careful listeners to problems and needs that may be addressed by design solutions, and they should assist consumers in selecting housing design options that meet their unique needs. Rehabilitation professionals may play an important role in facilitating communication between consumers and housing providers.

While attention to individual needs and desires is critical, it should be noted that some features were deemed to be desirable by all participants of the focus groups. In addition, many of these features likely would benefit all individuals, regardless of disability. For the Atlanta focus group, features in this category included pull-out kitchen shelving, lazy susans, and raised electrical outlets, along with features such as variable lighting control, wide doorways, and adequate maneuvering space on landings and at entryways.

Interestingly, both the Atlanta group and the Los Angeles group reported that raised outlets were a useful feature, but for different reasons. The Atlanta group reported they made plugging appliances in easier for older individuals, and the Los Angeles group reported that having them high on the wall was a safety benefit for young children. Lever handles reportedly made opening doors easier for children who have not fully developed wrist rotation abilities, and they may also be easier for older blind individuals who have limited range of motion in their wrists. The desirability of safe play areas and distinct paths of travel reported by the Los Angeles focus group should benefit non-disabled as well as disabled children, and may also benefit older adults who, because of orientation problems or cognitive deficits, are at risk for disorientation and have limited ability to recover once they are disoriented.

The possibility that features may be beneficial to disabled and non-disabled individuals alike is congruent with the concept of universal design. Universal design means "designing all products, buildings and exterior spaces to be usable by all people to the greatest extent possible" (Mace, Hardie and Place, 1991, p. 2). The results of this study give added impetus to the inclusion of certain widely desirable features into house plans currently being used in this country. It also points out the need to consider the affect of housing design features on all residents of the home, whether disabled or not.

It should be recognized that a fundamental difference exists in the housing design needs of individuals who are blind and individuals who have low vision. Individuals with total blindness reported few home modifications. While they were enthusiastic regarding some of the design features discussed by the group, none of the participants reported that they were planning to implement any of the changes. Anecdotal evidence seems to suggest that persons with blindness become so familiar with their home environment, and functioning in the home (e.g., mobility) is not typically problematic. It appears that blind adults without additional disabilities learn to manage relatively well with the housing design features present in the home at the time they move in, and they make few modifications. The modifications they suggested tended to be relatively "low-tech", such as the use of furniture placement as an aid in traveling independently in the home without a long cane or other mobility device. Blind individuals in the Atlanta group also

References

Bradfield, A., & Tucker, L. (1989). Visual performance in the workplace. Journal of Vision Rehabilitation, 3, 7-17.

Branch, L.G., Horowitz, A., & Carr, C. (1990). The implications for everyday life of incident self-reported visual decline among people over age 65 living in the community. The Gerontologist, 29, 359-365.

Brennan, V., Peck, F., and Lolli, D. (1992). Suggestions for modifying the home and school environment: A handbook for parents and teachers of children with dual sensory impairments. Watertown, Massachusetts: Perkins School for the Blind.

Cocke, E.A. (1992). Housing modifications for persons who are blind or visually impaired. RE:view, 24, 23-28.

Graves, W.H., Maxson, J.H., & McCaa, C. (1988) Assessing the environment of low vision persons: A validation procedure. Journal of Visual Impairment and Blindness, 82, 361-365.

Hill, E.W., Dodson-Burk, B., & Smith, B.A. (1989). Orientation and mobility for infants who are visually impaired. RE:view, 21(2), 47-60.

Kirchner, C. (1988). Data on blindness and visual impairment in the U. S., 2nd Edition. New York: American Foundation for the Blind.

Mace, R.L., Hardie, G.J., & Place, J.P. (1990). Accessible environments: Toward universal design. In W.E. Prieser, J.C. Vischer, & E.T. White (Eds.), Innovation by design (pp. 187-219). New York: Van Nostrand Reinhold.

Null, R.L. (1988a). Model kitchen design for the low vision elderly community. Journal of Visual Impairment and Blindness, 82, 240-245.

Null, R.L. (1988b). Kitchens designed for the low vision elderly. Journal of Vision Rehabilitation, 2, 45-53.

Rogers, P., & Long, R.G. (1991). The challenge of establishing a national service delivery program for older blind persons. Journal of Gerontological Social Work, 17, 153-163.

Sicurella, V.J. (1977). Color contrast as an aid for visually impaired persons. Journal of Visual Impairment and Blindness, 71, 252-257.

APPENDIX A

Summary List of Desirable Home Modifications for Persons with Low Vision and Blindness

Richard G. Long
September, 1992
NC State University, School of Design
Center for Accessible Housing

GENERAL

- Use large print LED readouts on thermostats, and install tactual markings or click type thermostats. Keypad entry of desired temperature can facilitate setting the thermostat.

- The ability to control lighting and having more lighting than is commonly installed in residences is perhaps the most desirable housing feature. This is not surprising, given that low vision individuals tend to have unique lighting needs depending on the degree and type of vision loss, the task for which lighting is required, and the individual's sensitivity to glare. The majority of blind people reported in a recent study that addition of lighting and its control was a more important feature that the addition of color contrasting surfaces, although both were beneficial modifications for some individuals. Contrast was reported to be more important feature outside the home, which is not surprising given that lighting is more difficult to control outside than inside.

- Avoid sunken floor areas in living spaces.

- Use rheostats on all light switches to permit a wide range of adjustment of lighting levels. Control of lighting with rheostats and adjustable blinds is a very important feature of lighting. Large windows and skylights that are tinted to reduce glare are very useful, as natural light is preferable to artificial light for some visual tasks. Increased lighting (both the wattage of bulbs and the number of fixtures), the ability to control lighting, reduction of glare sources, and the use of color contrast to mark edges and borders appear to be powerful environmental interventions for persons with low vision.

- Use switches that have distinct positions for "on" and "off." Rocker switches and rheostatic switches are annoying (and a potential safety hazard) because it is impossible to tell whether the device is on or off from the position of the switch. This is particularly important for persons who are blind.
- Use extra-wide doorways for ease of entry and exit to rooms. Pocket or sliding doors are also desirable, as they reduce the risk of walking into the edge of a half-open door.
- Maintain relatively direct paths from doors at each end of a room.
- Use recessed door handles. Some blind persons tend to hit their wrists and forearms on handles that protrude into the room or hallway.
- Use color-contrasting door frames to facilitate location of entryways into a room.
- Use flat finishes on floors to decrease problems with glare.
- Use railings that begin and end several feet before the first riser, as they can be helpful in locating and negotiating stairs. Stairs should have no open risers and should be of equal height and width.
- Install contrasting nosing on the leading edge of the stair.

KITCHEN

- Use stove with front mounted control.
- Install sliding cabinet doors or spring loaded hinges on cabinet doors.
- Avoid using protruding handles on cabinetry.
- Install pull out shelves or "lazy-susan" type revolving shelves to assist persons with low vision in bringing the contents of a cabinet into view.
- Install more storage than is commonly available in kitchens. This may improve functioning by facilitating use of organizational strategies that make things easier to find.
- Install a work surface of table height with clear space underneath so persons with low vision can sit and read a recipe book or perform activities such as mixing, slicing, or stirring. While seated, they can bend over to see what they are doing without the back strain that might result from bending over while standing.
- Use raised outlets and outlets between the countertop and overhead cabinets to avoid long lengths of electrical cord from countertop appliances.
- Install strip lighting under counters.

- Use Braille or large print labels in breaker box.
- Install lights in the freezer compartment as well as the refrigerator.
- Be consistent in electrical plug design (wide side consistently on left or right throughout home.
- Install countertops having a flat finish and solid, neutral color (Avoiding visual clutter is important for persons with low vision. Wallpaper should be solid or a relatively small pattern that does not clutter the visual background).

BATH

- In the bath, use faucets with separate controls for the hot and cold water, as it is difficult to know whether the water will be hot or cold with the single ball type faucet.
- Install mats and grab bars in shower area
- Install at least one mirror mounted so that it is possible to get very close to it, in order to see to put on makeup and do other grooming tasks.
- Install a light in the shower.

ENTRYWAY

- Use bright lighting at exterior doors, with motion or sound activated lighting preferred.
- Use lighted keyholes and doorbells.
- Use alarm control panels with tactile markings and audible confirmation when keys were depressed. Intercoms that allowed a person inside to answer the door from anywhere in the house are both a safety feature and a convenience.
- Use door thresholds that are flush with the floor to reduce the trip hazard of a conventional raised threshold.

EXTERIOR

- Use a brightly colored post or mailbox to facilitate finding the house from the street or sidewalk.
- Use walkway and entryway design that provides tactual cues as to changes in elevation. Sidewalks bordered with grass facilitate finding the entry door in darkness. Clearly delineated paths from the entryway to the sidewalk or street were also desirable.
- Use large landings at stairs, as they make entrance and egress to the residence easier.

APPENDIX B

Additional Readings

Compiled by ***Richard G. Long****, Ph.D.*
VA Medical Center Atlanta
1670 Clairmont Road
Decatur, Georgia 30033

From "Low Vision: The Resource"
October, 1992

Cardwell, H.D. (1982). Gardens and parks for everyone. Journal of Visual Impairment and Blindness, 76 , 155.

Cooper, B. A. (1985). A model for implementing color contrast in the environment of the elderly. American Journal of Occupational Therapy, 39 (4), 253-258.

Dickman, I.R. (1983). Making Life More Livable: Simple Adaptations for the Homes of Blind and Visually Impaired Older People. New York: American Foundation for the Blind.

Duncan, J., Gish, C., & Mulholland, M.E. (1977). Environmental modifications for the visually impaired: A handbook. Journal of Visual Impairment and Blindness, 71, 442-455.

Genensky, S.M., Berry, S.H., Bikson, T.H., & Bikson, T.K. (1979). Visual Environmental Adaptation Problems of the Partially Sighted: Final Report. Santa Monica: Center for the Partially Sighted.

Goldman, C. (1987). Disability rights guide: Practical solutions to problems affecting people with disabilities. Lincoln, NE: Media Publishing.

Graves, W.H., Maxson, J.H., & McCaa, C. (1988) Assessing the environment of low vision persons: A validation procedure. Journal of Visual Impairment and Blindness, 82, 361-365.

Groff, G., & Gardner, L. (1989). What museum guides need to know: Access for blind and visually impaired visitors. New York: American Foundation for the Blind.

Hall, A. (1980). Recommendations for evaluating innovative products for the visually handicapped. Journal of Visual Impairment & Blindness, 74 , 89-92.

Hiatt, L.G., & McQueen, C. (1982). Review of the literature on vision, hearing, and memory in old age with implications for self-help and environmental design. New York: American Foundation for the Blind.

Hooper, K. (1982). A handbook describing low cost concepts and techniques to make public transportation more accessible for visually and hearing impaired persons. Washington, D.C.: Urban Mass Transportation Administration, Crain-Revis Associates, Inc.

Julian, W.G. (1983). The design of the visual environment of the aged partially sighted. Architectural Society Review, 26, 112-115.

Lang, M.A., & Sullivan, C. (1986). Adapting home environments for visually impaired and blind children. Children's Environments Quarterly, 3 (1), 50-54.

McGillvray, R. (1984) Making the environment more visible. Aids and Appliances Review, 13, 5-10.

Sakamoto, L., & Mehr, E.B. (1988). A new method of stair markings for visually impaired people. Journal of Visual Impairment and Blindness, 82 , 24-27.

Schneekloth, L. H. (1980). Environments for handicapped children: Design guidelines. Blacksburg, VA: Virginia Polytechnic University.

Schneekloth, L.H., & Day, D. (1980). Comparison of environmental interactions and motor activity in visually handicapped and sighted children. Washington, D.C.: ERIC Documents.

Schneekloth, L.H., (1989). Play environments for visually impaired children. Journal of Visual Impairment and Blindness, 83 , 196-201.

Seven, S.M. (1980). Environmental interpretation for the visually impaired. Journal of Environmental Education, 11 (4), 42-50.

Steiner, C. (1983). Art museums and the visually handicapped consumer. Some issues in approach and design. Journal of Visual Impairment and Blindness, 77, 330-333.

Szlyk, J.P, Arditi, A., Coffey Bucci, P. & Laderman, D. (1990). Self-report in functional assessment of low vision. Journal of Visual Impairment and Blindness, 84 61-66.

Templer, J. & Zimring, C. (1981). Accessibility for Persons with Visual Impairments. Washington, D.C.: National Center for a Barrier Free Environment.

Weisse, F.A. & Greenblatt, S.L. (1988). Living with Low Vision: A Resource Guide for People with Sight Loss. Lexington, MA: Resources for Rehabilitation.